

PLASTICIZERS DERIVED FROM VEGETABLE OILS

CLAIMS

We claim:

- 1 (1) A plasticized vinyl chloride composition, comprising:
 - 2 (a) about 100 parts by weight of at least one vinyl chloride resin;
 - 3 (b) about 10 to 230 parts by weight of a plasticizer compounded with
4 said at least one vinyl chloride resin, wherein said plasticizer
5 comprises a fatty acid product derived from a vegetable oil having
6 at least 80% by weight of unsaturated fatty acids, wherein said
7 fatty acids are substantially fully esterified with a monool or a
8 polyol, and said esterified unsaturated fatty acids have been
9 substantially fully epoxidized;
 - 10 (c) said vegetable oil derived plasticizers composition comprising,
 - 11 (1) said fatty acid product derived from direct esterification of fatty
12 acids of said vegetable oil with a monool or a polyol;
 - 13 (2) said fatty acid product derived from transesterification of said
14 vegetable oil with monoools or polyols;
 - 15 (3) said fatty acid product derived from said vegetable oil
16 interesterified with another vegetable oil having a higher degree of
17 unsaturation; mixtures of the above; or
 - 18 (4) said fatty acid product derived from a fatty acids from said
19 vegetable oil esterified with a monool and interesterified with a
20 polysaccharide carboxylic acid ester. .
- 1 (2) The composition of claim 1, wherein said plasticized vinyl chloride
2 composition is essentially free of DOP.

1 (3) The composition of claim 1, wherein when said alcohol is a polyol and
2 said fatty acids derived from said vegetable oil are substantially
3 randomly positioned on the hydroxyl sites of said polyol.

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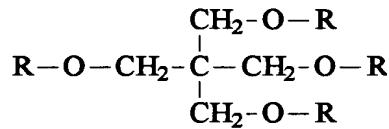
1 (4) The composition of claim 1, wherein said vegetable oil is selected from
2 the group consisting of,
3 canola oil (I.V. value about 100-115),
4 corn oil (I.V. value about 118-128),
5 linseed oil (IV. value about 170-200),
6 rapeseed oil (I.V. value about 100-115),
7 safflower oil (I.V. value about 140-150),
8 soybean oil (I.V. value about 120-143),
9 sunflower oil (I.V. value about 125-140),
10 tall oil (I.V. value about 140-190), and
11 tung oil (I.V. value about 180) (and mixtures of derivatives thereof) and
12 mixtures thereof.

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1 (5) The composition of claim 1, wherein said plasticizer composition is
2 derived from a vegetable oil having an iodine value above about 100.

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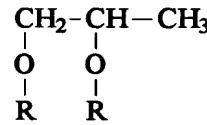
1 (6) The composition of claim 1, wherein said plasticizer composition is
2 epoxidized pentaerythritol tetrasoyate having the formula:



8 wherein R (each of the R's may be the same or different) is randomly
9 selected from the group consisting of:

10 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
11 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
12 and margaroyl.

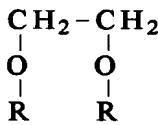
1 (7) The composition of claim 1, wherein said composition is epoxidized
2 propylene glycol diisoyate having the formula:



3 wherein R (each of the R's may be the same or different) is randomly
4 selected from the group consisting of:
5

6 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
7 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
8 and margaroyl.

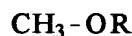
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1 (8) The composition of claim 1, wherein said composition is epoxidized
2 ethylene glycol diisoyate having the formula:



wherein R (each of the R's may be the same or different) is randomly selected from the group consisting of:

9 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
10 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
11 and margaroyl.

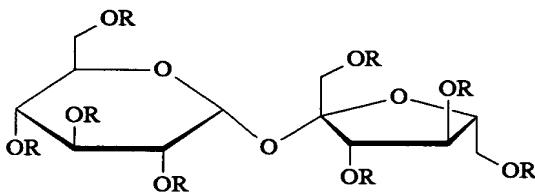
(9) The composition of claim 1, wherein said plasticizer composition is a mixture of epoxidized methyl soyate having the formula:



5 wherein R is randomly selected from the group consisting of:

6 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
7 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
8 and margaroyl.

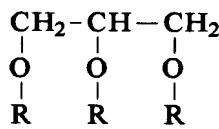
1 (10) The composition of claim 1, wherein said composition is epoxidized
2 sucrose octasoyate having the formula:



3
4 wherein R (each of the R's may be the same or different) is selected
5 from the group consisting of:
6 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
7 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
8 and margaroyl.

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1 (11) The composition of claim 1, wherein each R is randomly selected from
2 said group.

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1 (12) The composition of claim 1, wherein said composition is the epoxidized
2 product of a first vegetable oil interesterified with a second vegetable oil,
3 and having the formula:



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8 wherein R (each of the R's may be the same or different) is randomly
9 selected from the group consisting of:
10 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
11 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
12 and margaroyl.

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1 (13) The composition according to Claim 12, wherein said first vegetable oil
2 has an iodine value greater than 100 and the second vegetable oil
3 has an iodine value greater than the first vegetable oil.

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1 (14) The composition of claim 12, wherein said first vegetable oil is soybean
2 oil, and said second vegetable oil is linseed oil.

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1 (15) Epoxidized pentaerythritol tetrasoyate having the formula:

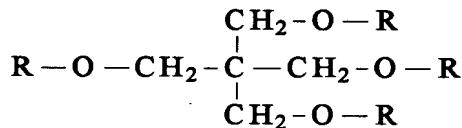
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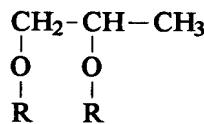


7 wherein R (each of the R's may be the same or different) is randomly
8 selected from the group consisting of:

9 (i) substantially fully epoxidized unsaturated fatty acids derived from a
10 vegetable oil; or
11 (ii) non-epoxidized saturated fatty acids derived from a vegetable oil;
12 wherein said vegetable oil has greater than about 80% unsaturated fatty
13 acids and/or an iodine number above about 100.

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1 (16) Epoxidized propylene glycol disoyate having the formula:



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3 wherein R (each of the R's may be the same or different) is randomly
4 selected from the group consisting of:

5 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
6 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
7 and margaroyl.

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1 (17) Epoxidized ethylene glycol disoyate having the formula:

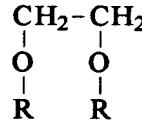
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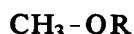


7 wherein R (each of the R's may be the same or different) is randomly
8 selected from the group consisting of
9 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
10 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
11 and margaroyl.

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1 (18) Epoxidized methyl soyate having the formula:

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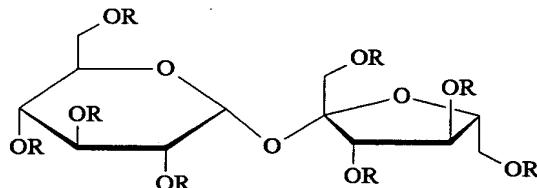


3 wherein R is randomly selected from the group consisting of:

4 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
5 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
6 and margaroyl.

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1 (19) Epoxidized sucrose octasoyate having the formula:



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3 wherein R (each of the R's may be the same or different) is selected
4 from the group consisting of:

5 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
6 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
7 and margaroyl.

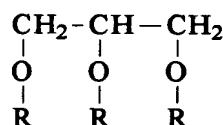
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1 (20) The composition of claim 1, wherein each R is randomly selected from
2 said group.

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1 (21) The epoxidized product of a first vegetable oil interesterified with a
2 second vegetable oil having the formula:

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8 wherein R (each of the R's may be the same or different) is randomly
9 selected from the group consisting of:

10 (i) epoxidized linoleoyl, oleoyl, linolenoyl, and palmitoleoyl; or
11 (ii) non-epoxidized palmitoyl, stearoyl, arachidoyl, behenoyl, myristoyl,
12 and margaroyl.

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1 (22) The composition of claim 21, wherein said first vegetable oil is soybean
2 oil, and said second vegetable oil is linseed oil.

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1 (23) A plasticized vinyl chloride composition, comprising:

2 (a) about 100 parts by weight of at least one vinyl chloride resin;
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with
4 said at least one vinyl chloride resin, wherein said plasticizer is
5 epoxidized pentaerythritol tetrasoyate; and
6 (c) about 1-3 parts thermal stabilizer compounded with said at least
7 one vinyl chloride resin and said plasticizer.

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1 (24) A plasticized vinyl chloride composition, comprising:

2 (a) about 100 parts by weight of at least one vinyl chloride resin;
3 (b) about 10 to 100 parts by weight of a plasticizer compounded with
4 said at least one vinyl chloride resin, wherein said plasticizer is
5 epoxidized propylene glycol disoyate; and
6 (c) about 1-3 parts thermal stabilizer compounded with said at least
7 one vinyl chloride resin and said plasticizer.

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1 (25) A plasticized vinyl chloride composition, comprising:

2 (a) about 100 parts by weight of at least one vinyl chloride resin;

3 (b) about 10 to 100 parts by weight of a plasticizer compounded with

4 said at least one vinyl chloride resin, wherein said plasticizer is

5 epoxidized ethylene glycol disoyate; and

6 (c) about 1-3 parts thermal stabilizer compounded with said at least

7 one vinyl chloride resin and said plasticizer.

1 (26) A plasticized vinyl chloride composition, comprising:

2 (a) about 100 parts by weight of at least one vinyl chloride resin;

3 (b) about 10 to 100 parts by weight of a plasticizer compounded with

4 said at least one vinyl chloride resin, wherein said plasticizer is

5 epoxidized methyl soyate; and

6 (c) about 1-3 parts thermal stabilizer compounded with said at least

7 one vinyl chloride resin and said plasticizer.

1 (27) A plasticized vinyl chloride composition, comprising:

2 (a) about 100 parts by weight of at least one vinyl chloride resin;

3 (b) about 10 to 100 parts by weight of a plasticizer compounded with

4 said at least one vinyl chloride resin, wherein said plasticizer is

5 epoxidized sucrose octasoyate; and

6 (c) about 1-3 parts thermal stabilizer.

1 (28) A plasticized vinyl chloride composition, comprising

2 (a) about 100 parts by weight of at least one vinyl chloride resin; and

3 (b) about 10 to 100 parts by weight of a plasticizer compounded with

4 said at least one vinyl chloride resin, wherein said plasticizer is the

5 epoxidized product of a first ester interesterified with a second

6 ester; and

7 (c) about 1-3 parts thermal stabilizer compounded with said at least

8 one vinyl chloride resin and said plasticizer.

1 (29)A plasticized vinyl chloride composition, comprising

2 (a) about 100 parts by weight of at least one vinyl chloride resin; and

3 (b) about 10 to 100 parts by weight of a plasticizer compounded with

4 said at least one vinyl chloride resin, wherein said plasticizer is the

5 epoxidized product of a first vegetable oil interesterified with a

6 second vegetable oil; and

7 (c) about 1-3 parts thermal stabilizer compounded with said at least

8 one vinyl chloride resin and said plasticizer.

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1 (30) The composition of claim 28, wherein said first vegetable oil is soybean

2 oil, and said second vegetable oil is linseed oil.

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